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GATEWAYS

Degree Program Alternatives

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ABSTRACT

Los Alamos National Laboratory is using non-traditional solutions to assist employees in attaining degrees required for essential Laboratory operations. Varieties of distance learning technologies have been implemented to meet some degree needs. While distance learning is not always a perfect solution, it enables the Laboratory to provide education that would otherwise not be practical for full-time employees. The Laboratory has also formed partnerships with local colleges to design programs to fill particular needs. Meeting the challenge of providing cost-effective, viable degree programs in an isolated location requires both patience and innovation.

Key Words: Distance learning, partnerships, needs assessment.

INTRODUCTION

Los Alamos National Laboratory supports and sponsors degree programs for its employees in order to help attract and retain the staff required to succeed in its mission. The support for these programs is provided by the Employee and Organization Development Group (HRD-3) which oversees the development, implementation and delivery of these programs. This paper identifies issues that require the attention and response of a training specialist in order to ensure success. It also suggests some techniques that can assist in achieving a quality product.

Los Alamos is one of the largest multidisciplinary, multiprogram national laboratories in the United States. Its mission is to apply science and technology to problems related to national security, energy supply, and other areas of national importance. National security, which provides 75% of the budget, includes nonnuclear programs as well as nuclear. The country's effort in environment, safety and health is becoming increasingly important at Los Alamos.

Los Alamos National Laboratory is located in the mountains of northern New Mexico on a high plateau at 7500 feet above sea level. Los Alamos was chosen for the Manhattan Project during World War II because of its relative isolation. Forty-five years later Los Alamos may not seem as remote because of better roads. However Albuquerque, site of the nearest University, is almost 100 miles away. Santa Fe with two small liberal arts colleges and a community college is 35 miles away. In order to attract the staff it needs, the Laboratory has long recognized that educational opportunities must be available to its employees. To meet this need the University of New Mexico (UNM) Los Alamos Graduate Center (LAGC) was established in 1956 and represents a unique cooperative venture between the Laboratory and UNM. The LAGC is not funded by state taxes, but entirely by the Laboratory. Over the years the Graduate Center has been a primary source of graduate degree programs offered to employees at the Laboratory but until recently, most programs were not systematic or sequential. Nor was there any method to increase the variety of degree options.

The Laboratory employs approximately 7,300 people. A little over 3,000 of these are technical staff members, that is scientists and engineers. The remaining employees are technicians, administrative and general support personnel. Of the technical staff members,

almost half hold doctoral degrees, 26% have masters' degrees and 23% have bachelors' degrees.

NEEDS ASSESSMENT

Employees at the Laboratory, with the support of tuition reimbursement, have earned degrees which have enhanced their careers and capabilities. In addition to a commitment to education, the Laboratory has a commitment to affirmative action and has supported programs that have made it possible for minorities and women to obtain or upgrade jobs at the Laboratory. A particular example is the reentry program for women sponsored by Women in Science, UNM/LA and the Laboratory. Women earn associate degrees in technical fields while holding an internship at the Laboratory. Most of these women have obtained permanent jobs and some have furthered their education by earning bachelor's degrees in engineering. The internship program is now being expanded to include minority males.

Another reason for strong educational programs for employees is to meet new demands as the country's and the Laboratory's priorities change. Laboratory programs often require degrees that did not exist ten or fifteen years ago. In the Environment, Safety and Health (ES&H) fields there are not enough current graduates to meet the nation's needs, which means the Laboratory's are not met either. On the other hand, sometimes Laboratory programs suddenly lose all funding leaving valuable employees without jobs. As a result, adaptation and change has also become a way of life for many of the people at Los Alamos. As is true everywhere, no longer can an individual expect to work for a lifetime in the same career. Means of changing directions are needed. Shifting from one technical degree to another, changing from a nontechnical degree to a technical one, or adding a management degree to another degree are all paths that Laboratory employees are choosing for themselves.

Therefore, both the organization and its employees have a need for degree programs. In order to determine needs, a systematic process is needed for determining goals, identifying discrepancies between goals and the status quo and establishing priorities for action. Documentation is needed which confirms first, the current status of programs and second, predicts future needs. In other words, what do we already know and what do we need to find out?

A recent informal needs assessment focused on defining and analyzing available sources pertaining to Laboratory technical degree needs. Using nonintrusive methods, a list of available resources was compiled. In accessing these resources far more data was produced than was expected. Use was made of information and records provided by our personnel department, library services, local colleges and universities, the AA/EEO Office, University Relations Office, and other organizations within and without the Laboratory.

The type and number of graduate degrees granted by UNM through the LAGC were examined along with distributions of current enrollments. Associate degrees and certificate programs awarded by UNM-LA, the graduates of the Women in Science Reentry Program, and other technical programs offered by local and community colleges were noted. Other master's degree programs such as those available from National Technological University (NTU) were reviewed. Annual reports that various divisions had generated were collected. Unfortunately, most of the reports made no projections about future staff. Finally, degrees of people hired into special programs (post-docs and graduate students) were compared with degree distribution among regular staff members. This data clarified what programs are currently available locally and who is using them.

Another aspect of the needs assessment was to examine our equipment and space, quantifying their present use. Currently, we receive four microwave channels broadcast from UNM and have one satellite dish. It came as no surprise that classroom space is inadequate for present demands. After completing the assessment, HRD-3 was able to benchmark current status but more precise data is needed for setting priorities for the future.

Earlier a fully developed needs assessment was conducted which led to a Bachelor of Science in Electrical Engineering, a Laboratory sponsored program which offered both tuition reimbursement and release time. A survey was sent to all Laboratory group leaders asking if a technical bachelor's degree program would meet needs and goals in their groups and if so would they be willing to support such a program with tuition payments and release time. The survey showed that 77% of the technical managers felt their group's mission would be supported by such a program, 62% were willing to financially support such a program, and 73% would be willing to give release time for classes. The questionnaire also surveyed future staff needs. Computer science ranked highest, followed by electrical engineering and mechanical engineering. In the end, electrical engineering was chosen for the pilot because there were more applicants for that program than any of the other choices.

Further informal assessment was done before computer science was chosen for the second phase of the BS program. Telephone surveys were conducted with division offices asking for an update on personnel needs. These findings were correlated with evaluation results from the pilot program in electrical engineering. Job placement of graduates was tracked; all were eventually placed in positions which utilized their new expertise. Results of this evaluation showed a continued need for bachelor's degrees in computer science and electrical engineering.

DISTANCE LEARNING

Distance learning is one of the keys in meeting degree needs. Therefore, the Laboratory has invested in the technology necessary to implement distance education programs. We are able to receive NTU Master's Degree programs by satellite and microwave transmission from UNM. Recently an audiographics system was introduced in the Training and Learning Technology (TLT) Program from UNM. While some undergraduate courses are delivered by Instructional Television (ITV), graduate programs depend almost entirely on satellite and microwave transmissions. There are many technical issues and considerations for distance education systems. However, the focus here will be the advantages of the system and the problems that training specialists must overcome.

Distance learning increases degree options at an isolated site since it can deliver programs without the guarantee of large enrollments. The variety of courses needed for degrees would simply not be available in Los Alamos without this technical capability. The UNM Graduate Center at Los Alamos (LAGC) does offer a limited number of courses using live instructors and is currently budgeted for 40 classes. These are primarily taught by adjunct professors recruited from the Laboratory and, while they generally have a good reputation, they cannot begin to deliver a systematic program for degree completion.

NTU offers a number of complete master's degree programs that are difficult to obtain in any other reasonable way. However, NTU's programs are expensive. A less expensive way to get sequenced and systematic offerings is to access the full time faculty on the main campus of UNM through interactive and live television. LAGC offers graduate courses in electrical engineering, mechanical engineering, waste management, nuclear engineering, civil engineering, radiation protection, computer science and mathematics. Currently, the

LAGC budget permits 97 ITV courses each year, which triples the number of courses that can be offered. These are fed into three classrooms which also have several microphones for voice connection.

The electrical engineering master's degree program is an example of a systematic and sequenced program. The electrical engineering department has made a commitment so that an individual can start the program at any time and complete all courses needed for a master's degree in three years time. Eighteen courses are broadcast each semester. Although most of the courses are on the graduate level, some of the prerequisites are undergraduate. The present schedule has been on line for three semesters. Sixty-eight Laboratory employees have participated in the classes during that time, which is about 50% higher than originally estimated. About half of those taking courses have applied for a degree; others are delaying their application or are only taking those courses which are of direct interest or job related. A few are taking courses for their PhD's. In the future, the Laboratory hopes to negotiate for other ITV programs organized in this sequential way.

Currently, some departments schedule their allotted ITV time with high interest courses, leaving out courses which are required for a degree. This may mean that the student will have to commute 200 miles round trip to Albuquerque to take classes required to finish a degree. This lack of systematic scheduling can mean years of delay in completing course requirements which makes passing comprehensive exams difficult. Some of these difficulties are due to a limited capacity to broadcast or receive classes. Priorities have to be set for classes to be received by ITV based on the Laboratory's need. A commitment to deliver, such as made by the electrical engineering department, can also assist a department in obtaining a higher priority for scheduling with the LAGC.

Although the microwave system was developed to increase degree choices, other advantages have become apparent as distance learning programs have been evaluated. Tapes are available to individuals who have missed the broadcast because of job related travel. For some employees this factor alone makes it possible to work on a degree. A student also has the option to review a difficult lecture. Because of the Laboratory's funding of the LAGC and an agreement with the electrical engineering department, tapes are kept in a permanent library and are available to all Laboratory employees for preview as well as review. The tapes are particularly useful for refreshing memories of prerequisite courses taken years earlier.

Another advantage of distance learning for some students is the atmosphere of the classroom. Since classes are small, students often develop close bonds. The students are able to discuss what the professor has said without interrupting the parent classroom. Laughter is often shared. Some professors perceive that this environment is disrespectful but evaluations have shown that students taking ITV courses are serious and most of them are doing better than average.

Unfortunately, there are problems and disadvantages to distance learning that might require intervention from a training specialist. The delivery of classroom instruction by ITV may not be of high quality. Many classroom instructors have little experience or training in delivering distance instruction. The delivery may be poor and the writing on the board or may not be legible or even visible. Viewgraphs may not be readable. If there is no reward, recognition or additional pay, there is little incentive for professors to improve their instruction.

Further, distance students do not have easy access to instructors. Distance students can feel like second class citizens. They may not get assignments or materials in a timely fashion. If materials or assignments are faxed, they may not be readable. As a corporate

paying customer, an institution such as the Laboratory may be able to change conditions more easily that an individual. However, academic institutions do not appreciate outsiders infringing on their prerogatives, particularly if it affects the autonomy of the professors. Therefore, it is important that tracking and evaluation provide good data on quality issues.

There are other problems which may be due to inadequate funding or institutional priorities. Camera technique may be poor. Clerical support may not be sufficient enough to service students in outlying areas. Services such as counseling, libraries, teaching assistants and scholarships are often not available to distant sites. Knowledgeable proctors are not available during exams so that students may have to guess at the meaning of questions and intent.

In dealing with distance learning, the training specialist must not only document and handle logistics, but try to overcome many of these disadvantages. The Laboratory requests that the professor come to Los Alamos once a semester to meet the students in person. Students can be directed to services comparable to those found on campuses. Fortunately, library services at Los Alamos are excellent. Laboratory counseling services may be made available for students who have problems at home or at work because of the stress generated by difficult courses combined with heavy work schedules and family responsibilities. Training specialists can sometimes successfully intervene with the institution on behalf of the students to find favorable solutions to individual problems. Study groups can be encouraged and provided with logistical support. Teaching assistants may be recruited from those who have already graduated or mentors can sometimes be found in the ranks of a student's co-workers.

PARTNERSHIPS WITH LOCAL INSTITUTIONS

Sometimes a need exists for which there is no readily available solution. At the Laboratory, for example, there is a foreseen shortage in the emerging ES&H fields. There are Masters degree programs which the Laboratory can access and a new Associate Degree Program in environmental science at UNM/LA. However, locally there was no way for a Los Alamos employee to get a bachelor's degree in environmental science or in any particular ES&H field. Along with the Laboratory's need, there are employees who wish to earn a long deferred bachelor' degree in an emerging field. Other individuals simply want to change direction and move to a field in which they see both need and reward.

At the same time small liberal arts colleges are losing traditional enrollment for a variety of reasons. As a result, small colleges have to be innovative. The College of Santa Fe (CSF) has chosen to develop their External Programs to serve the employed adult population. The classes for these programs are, of necessity, held on evenings and weekends. Generally, courses are concentrated and presented one at a time in sequence. Their first collaboration with LANL was the final two years of a bachelor's degree in business. Two groups of students have completed the program within two years by taking the courses entirely on weekends.

Not surprisingly, The College of Santa Fe expressed interest when the Laboratory began to search for a way to fill the environmental science gap. However, CSF was a liberal arts college and the

laboratory felt that they needed a strong technical program that would prepare their employees for master's degree programs in fields such as waste management, industrial hygiene, environmental engineering, health physics, and radiation protection engineering. In response to their proposal, a curriculum committee was formed comprised of individuals from the appropriate divisions at the Laboratory as well as CSF. Together they developed

a strong technical curriculum which still met the liberal arts requirements of CSF. Where CSF does not have the staff to teach specific technical electives, adjunct professors can be found among the Staff Members at the Laboratory. Undergraduate internships at the Laboratory are planned as part of the program.

When designing an educational program such as this, it is important to give it every chance of success. That success depends on the success of the individuals who are enrolled in the program. This does not mean watering the courses down or scheduling easy courses. The schedule should give the student time to absorb the material and to do the required work. Missing prerequisites should be scheduled before the prerequisite is needed. At the same time, it is important to the Laboratory that the program be of high quality and truly prepare one for graduate degree programs.

Clearly, the Environmental Degree Program would be a tough program. It was important to look for the ways that it could be designed keeping the success of the students in mind. The business program courses were given on two long weekends, Friday night, all day Saturday and Sunday, with a weekend in between. HRD-3 strongly urged that the environmental science program be designed in a less concentrated way. As a result the program was set up as a three year program with the weekend courses given for three weekends on Saturday and Sunday only, again with weekends between. Science and math courses are scheduled for a weekday evening for eight consecutive weeks with labs on Saturday mornings.

The required first two years of prerequisites were designed to be technically strong so that students would be prepared for a rigorous upper division curriculum. The prerequisites include general biology, chemistry, and physics as well as math through one year of college calculus. It is very unusual to find someone who has all of these courses by the end of their sophomore year. This meant that almost no one admitted to the program actually had all the prerequisites. CSF recognized this and has tried to be as accommodating as possible. For example, most applicants did not have the computer science requirement; however, most use computers on their job in a manner well beyond the beginning course in computer science. CSF has arranged for portfolio credit, which means that with documentation of job experience, credit can be given. Some prerequisite courses can be taken at the Los Alamos Branch of UNM. CSF will offer other prerequisite courses so that they can be taken before they are needed for another course.

The program has just begun. There are 25 students enrolled and they are presently half way through their second course. This will not be an easy three years for them. Already job demands are making things difficult. The beginning of the program coincided with the Tiger Team's visit to Los Alamos which greatly impacted their workload and has required long work days for some of them. At HRD-3's request, a prerequisite general biology course, because of the Tiger Team visit, was postponed. This will mean some readjustment in the course schedule to accommodate this change. This kind of adaptability is an important aspect of the chosen institution. The program has to be doable as well as of high quality.

In getting a program like this on line, there may be difficulties that are not foreseen. Both internal and external approvals can hold things up at the last minute if they have not been anticipated. For example, the Laboratory's prime contract with DOE requires contract officer approval for undergraduate programs. Documentation had to be gathered at the last minute to obtain that approval. The program started on time, but not without a lot of attentio and coordination on the part of the training specialist. To prevent this from happening again, a checklist is being developed which should help track all approvals as well as all the other steps in developing a program.

With all degree programs, the timing of approvals, even when anticipated, can cause problems. Publicity should not come out before approval signatures are obtained, but the publicity often has to be scheduled in advance. Applicants need a reasonable amount of time to prepare applications, including getting transcripts and recommendations. While obtaining those important approval signatures, the ample amount of time figured in can disappear. More time should be allowed than seems reasonable for the approval process.

Private lives of the students must not be discounted. An intensive program such as this impacts the lives of the participants' families almost as much as it effects the participants. Time for holidays and breaks must be planned into the schedule. Concern and respect for the problems that evolve is important. Study groups and support for each other should be encouraged. Occasionally, social activities can be planned which could include families. While the employer has a right to expect all employees to perform their jobs as usual, an understanding of the difficulties that a student has and some accommodation with overtime or flextime could be appropriate. The employer must value individuals who have the determination and discipline to complete a degree program while working full time.

CONCLUSION

Coordinating degree programs is an ongoing process. The training specialist is never completely on top of all the possible problems. However, it is an assignment where there is the possibility of personal reward, especially if making a difference in people's lives is an important goal of the training specialist. Without doubt, facilitating degree programs can have a positive impact on individuals' careers and on the Laboratory's ability to meet the challenges of the future.